

CLAIMS

- 1 1. A method for executing uniprocessor (UP) coded workloads in a multiprocessor
2 (MP) computer system without having to rewrite the UP-coded workloads' code, the
3 method comprising the steps:
4 organizing the UP-coded workloads into one or more concurrency groups,
5 wherein UP-coded workloads in the same concurrency group are not permitted to execute
6 concurrently with one another in the MP computer system;
7 scheduling first and second execution vehicles that respectively execute on differ-
8 ent processors in the MP computer system at substantially the same time;
9 acquiring a first concurrency group by the first execution vehicle and a second
10 concurrency group by the second execution vehicle; and
11 executing UP-coded workloads in the first concurrency group through the first
12 execution vehicle at substantially the same time as UP-coded workloads in the second
13 concurrency group are executed through the second execution vehicle.
- 1 2. The method according to claim 1, wherein the UP-coded workloads are UP-coded
2 threads, and the first and second execution vehicles are first and second processes.
- 1 3. The method according to claim 1, wherein the UP-coded workloads are messages,
2 and the first and second execution vehicles are first and second threads.
- 1 4. The method according to claim 1, wherein the step of acquiring the first and sec-
2 ond concurrency groups further comprises:
3 dequeueing from a concurrency-group run queue a first concurrency-group data
4 structure associated with the first concurrency group; and
5 dequeueing from the concurrency-group run queue a second concurrency-group
6 data structure associated with the second concurrency group.
- 1 5. The method according to claim 4, further comprising:

2 setting a first CG flag in the first concurrency-group data structure to a value indi-
3 cating that the first concurrency group is in a running state; and

4 setting a second CG flag in the second concurrency-group data structure to a
5 value indicating that the second concurrency group is in a running state.

1 6. The method according to claim 4, further comprising:

2 appending UP-coded workloads enqueued on a first current queue in the first
3 concurrency-group data structure onto a first active queue in the first concurrency-group
4 data structure; and

5 appending UP-coded workloads enqueued on a second current queue in the sec-
6 ond concurrency-group data structure onto a second active queue in the second
7 concurrency-group data structure.

1 7. The method according to claim 6, further comprising:

2 dequeueing UP-coded workloads in the first and second concurrency groups from
3 the first and second active queues, respectively; and

4 executing the dequeued UP-coded workloads to completion.

1 8. The method according to claim 5, further comprising:

2 in response to the first execution vehicle finishing execution of the UP-coded
3 workloads in the first concurrency group, the first execution vehicle performing the steps:

4 A) if at least one UP-coded workload in the first concurrency group is
5 executable:

6 (i) setting the value of the first CG flag to a value indicat-
7 ing that the first concurrency group is in a queued state;

8 (ii) re-enqueueing the first concurrency-group data struc-
9 ture onto the concurrency-group run queue;

10 B) if there are not any UP-coded workloads in the first concurrency
11 group that are executable, setting the first CG flag to a value indicating that the
12 first concurrency group is in a suspended state;

13 C) dequeuing from the concurrency-group run queue a third
14 concurrency-group data structure associated with a third concurrency group; and
15 D) setting a third CG flag in the third concurrency-group data structure to
16 a value indicating that the third concurrency group is in a running state.

1 9. The method according to claim 1, wherein at least one of the UP-coded workloads
2 is organized into the one or more concurrency groups at run-time.

1 10. The method according to claim 1, wherein the MP computer system is a network
2 cache.

1 11. A multiprocessor (MP) computer system configured to execute uniprocessor (UP)
2 coded threads without having to rewrite the UP-coded threads' code, the MP computer
3 system comprising:

4 a plurality of processors;

5 a memory having a plurality of storage locations addressable by the plurality of
6 processors for storing data and program code, the memory being configured to store a
7 separate concurrency-group data structure for each of a plurality of concurrency groups,
8 each concurrency-group data structure comprising:

9 an active-queue pointer storing a location in the memory of an active
10 queue of UP-coded thread messages associated with UP-coded threads in an ex-
11 ecutable state; and

12 a current-queue pointer storing a location in the memory of a current
13 queue of UP-coded thread messages associated with UP-coded threads waiting to
14 be transferred to the active queue.

1 12. The MP computer system according to claim 11, wherein each concurrency-group
2 data structure further comprises a CG flag that stores a value indicating an operational
3 state of a concurrency group associated with the concurrency-group data structure.

1 13. The MP computer system according to claim 11, wherein each UP-coded thread
2 message stored in the active queue and current queue stores a location in the memory of a
3 top of a call stack associated with a specific UP-coded thread.

1 14. The MP computer system according to claim 13, wherein the call stack is accessi-
2 ble through a thread control block (TCB) associated with the specific UP-coded thread,
3 the TCB including a CG pointer for storing a memory location of a concurrency-group
4 data structure.

1 15. The MP computer system according to claim 11, wherein each concurrency-group
2 data structure further comprises meta-data information associated with a concurrency
3 group.

1 16. The MP computer system according to claim 11, wherein the MP computer sys-
2 tem is a network cache.

1 17. An apparatus for executing uniprocessor (UP) coded workloads in a multiproces-
2 sor (MP) computer system without having to rewrite the UP-coded workloads' code, the
3 method comprising the steps:

4 means for organizing the UP-coded workloads into one or more concurrency
5 groups, wherein UP-coded workloads in the same concurrency group are not permitted to
6 execute concurrently with one another in the MP computer system;

7 means for scheduling first and second execution vehicles that respectively execute
8 on different processors in the MP computer system at substantially the same time;

9 means for acquiring a first concurrency group by the first execution vehicle;

10 means for acquiring a second concurrency group by the second execution vehicle;

11 and

12 means for executing UP-coded workloads in the first concurrency group through
13 the first execution vehicle at substantially the same time as UP-coded workloads in the
14 second concurrency group are executed through the second execution vehicle.

- 1 18. The apparatus according to claim 17, wherein the UP-coded workloads are UP-
2 coded threads, and the first and second execution vehicles are first and second processes.
- 1 19. The apparatus according to claim 17, wherein the UP-coded workloads are mes-
2 sages, and the first and second execution vehicles are first and second threads.
- 1 20. The apparatus according to claim 17, further comprising:
2 means for dequeuing from a concurrency-group run queue a first concurrency-
3 group data structure associated with the first concurrency group; and
4 means for dequeuing from the concurrency-group run queue a second
5 concurrency-group data structure associated with the second concurrency group.
- 1 21. The apparatus according to claim 20, further comprising:
2 means for setting a first CG flag in the first concurrency-group data structure to a
3 value indicating that the first concurrency group is in a running state; and
4 means for setting a second CG flag in the second concurrency-group data struc-
5 ture to a value indicating that the second concurrency group is in a running state.
- 1 22. The apparatus according to claim 20, further comprising:
2 means for appending UP-coded workloads enqueued on a first current queue in
3 the first concurrency-group data structure onto a first active queue in the first
4 concurrency-group data structure; and
5 means for appending UP-coded workloads enqueued on a second current queue in
6 the second concurrency-group data structure onto a second active queue in the second
7 concurrency-group data structure.
- 1 23. The apparatus according to claim 22, further comprising:
2 means for dequeuing UP-coded workloads in the first and second concurrency
3 groups from the first and second active queues, respectively; and
4 means for executing the dequeued UP-coded workloads to completion.

- 1 24. The apparatus according to claim 21, further comprising:
2 means for setting the value of the first CG flag to a value indicating that the first
3 concurrency group is in a queued state or in a suspended state; and
4 means for re-enqueueing the first concurrency-group data structure onto the
5 concurrency-group run queue.
- 1 25. A computer-readable media comprising instructions for execution in one or
2 more processors for executing uniprocessor (UP) coded workloads in a multiprocessor
3 (MP) computer system without having to rewrite the UP-coded workloads' code, the
4 method comprising the steps:
5 organizing the UP-coded workloads into one or more concurrency groups,
6 wherein UP-coded workloads in the same concurrency group are not permitted to execute
7 concurrently with one another in the MP computer system;
8 scheduling first and second execution vehicles that respectively execute on differ-
9 ent processors in the MP computer system at substantially the same time;
10 acquiring a first concurrency group by the first execution vehicle and a second
11 concurrency group by the second execution vehicle; and
12 executing UP-coded workloads in the first concurrency group through the first
13 execution vehicle at substantially the same time as UP-coded workloads in the second
14 concurrency group are executed through the second execution vehicle.
- 1 26. The computer-readable media according to claim 25, wherein the UP-coded
2 workloads are UP-coded threads, and the first and second execution vehicles are first and
3 second processes.
- 1 27. The computer-readable media according to claim 25, wherein the UP-coded
2 workloads are messages, and the first and second execution vehicles are first and second
3 threads.
- 1 28. A method for executing workloads in a multiprocessor (MP) computer system, the
2 method comprising the steps:

3 organizing the workloads into one or more concurrency groups, wherein work-
4 loads in the same concurrency group are not permitted to execute concurrently with one
5 another in the MP computer system;
6 scheduling first and second execution vehicles that respectively execute on differ-
7 ent processors in the MP computer system at substantially the same time;
8 acquiring a first concurrency group by the first execution vehicle and a second
9 concurrency group by the second execution vehicle; and
10 executing workloads in the first concurrency group through the first execution ve-
11 hicle at substantially the same time as workloads in the second concurrency group are
12 executed through the second execution vehicle.

1 29. The method according to claim 28, wherein the step of acquiring the first and sec-
2 ond concurrency groups further comprises:

3 dequeueing from a concurrency-group run queue a first concurrency-group data
4 structure associated with the first concurrency group; and
5 dequeueing from the concurrency-group run queue a second concurrency-group
6 data structure associated with the second concurrency group.

1 30. The method according to claim 29, further comprising:

2 setting a first CG flag in the first concurrency-group data structure to a value indi-
3 cating that the first concurrency group is in a running state; and
4 setting a second CG flag in the second concurrency-group data structure to a
5 value indicating that the second concurrency group is in a running state.

1 31. The method according to claim 29, further comprising:

2 appending workloads enqueued on a first current queue in the first concurrency-
3 group data structure onto a first active queue in the first concurrency-group data struc-
4 ture; and
5 appending workloads enqueued on a second current queue in the second
6 concurrency-group data structure onto a second active queue in the second concurrency-
7 group data structure.

- 1 32. The method according to claim 31, further comprising:
2 dequeueing workloads in the first and second concurrency groups from the first
3 and second active queues, respectively; and
4 executing the dequeued workloads to completion.
- 1 33. The method according to claim 30, further comprising:
2 in response to the first execution vehicle finishing execution of the workloads in
3 the first concurrency group, the first execution vehicle performing the steps:
4 A) if at least one workload in the first concurrency group is executable:
5 (i) setting the value of the first CG flag to a value indicat-
6 ing that the first concurrency group is in a queued state;
7 (ii) re-enqueueing the first concurrency-group data struc-
8 ture onto the concurrency-group run queue;
9 B) if there are not any workloads in the first concurrency group that are
10 executable, setting the first CG flag to a value indicating that the first concurrency
11 group is in a suspended state;
12 C) dequeueing from the concurrency-group run queue a third
13 concurrency-group data structure associated with a third concurrency group; and
14 D) setting a third CG flag in the third concurrency-group data structure to
15 a value indicating that the third concurrency group is in a running state.